

A maximum of illumination is displayed at a selectable minimum engine power point, and a minimum of illumination is displayed at a selectable maximum engine power point. No illumination is displayed above the set maximum engine power point. An electronic circuit that is part of the illuminating device controls the illumination of the display segments as a function of a dc analog voltage input from a vehicle throttle position sensor.

#### **BRIEF DESCRIPTION OF THE DRAWINGS**

12. Figures 1 (A & B) are views of a first embodiment of the invention with a typical electronic control circuit.
13. Figures 2 (A, B, C, & D) are views of a typical electronic control circuit for a second embodiment of the invention.
14. Figures 3 (A & B) are views of a third embodiment of the invention with a typical electronic control circuit.

#### **DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS**

15. The present invention is an illuminating device for use on a motor vehicle. The first embodiment of the invention, as disclosed in Figs. (1 A & B), is comprised of an inverse function illuminating engine power indicator combined with a break light. Circuit dc power V1+ from 13 of Fig. 1B is connected to driver ICs 16 and 17 at pins 3 and 9. A dc voltage from a vehicle throttle position sensor is input to the electronic circuit at 10, conducts through the normally closed side of contact 20 to input pins 5 of dot/bar display drivers 16 and 17. Potentiometer R1 at 22 is adjusted for a selected high-end voltage to be applied at the top end of an internal voltage divider in second bar/dot driver 17. Variable resistor R4 at 24 is adjusted for a low-end voltage and applied to the low end of the internal voltage divider in first bard/dot driver 16 at pin 4. The high end of the voltage divider in first bar/dot driver 16 at pin 6 is connected to the low end of bard/dot driver 17 at pin 4, electrically connecting the voltage dividers of bar/dot drivers 16 and 17 in series. The selected high and low

end voltages applied to bar/dot drivers 16 and 17 determine the input voltage range that will operate the ten driver outputs each of bar/dot drivers 16 and 17. The outputs of drivers 16 and 17 are connected to the anodes of the light emitting diode loads, (herein after LEDs), between the current adjusting resistors 9 and LEDS 8. This connection causes the outputs of the bar drivers to switch the LEDs to on with no input, or a low input on pins 5 of bar dot drivers 16 and 17. As the input voltage at 10 increases above the selected low end voltage of bar driver 16, the first output of driver 16 at pin 4 is switched to on, and LEDs 20 A&B on the left and right end of display 25 are de-energized. Increasing input voltage at 10 will turn off the LEDs in sequence from a first and a second end of display 25, working in to the center of display 25. Input voltage 10 above the high-end set-point voltage 22 will turn on all outputs of drivers 16 and 17 and turn off all LEDs in display 25. Decreasing the dc input voltage at 10 down to the top of range set point will turn off the top display driver output pin 10 of bar/dot driver 17 illuminating the center segments of display 25. Further decreases in input voltage 10 will turn off more bar/dot driver 17 and 16 outputs and illuminate more display segments adjacent both sides of the center display segment.

- 16    Automotive break circuit voltage applied to relay K1 at 7 would energize K1 and operate first form "C" contact 20. Operation of form "C" contact 20 will remove the throttle position sensor voltage from dot/bar driver inputs 5 and connect said inputs 5 to system common 6. Connection of dot/bar driver input pins 5 to system common 6 would de-energize all bar driver outputs from 16 and 17 and illuminate all LEDs 8 in the display simultaneously. Operation of the second form "C" contact 19 of relay 18 will change the dc voltage supply to the LEDs at 11 and 12 from V3 (+5 vdc) at 15 to V2 (+ 7 vdc) at 14 illuminating all LEDS in display 25 at full or brake light intensity.
- 17    The second embodiment of the invention is disclosed in Fig. 2 (A, B, C, & D). Two horizontal rows of LEDs with series current limiting resistors are depicted in Figs. 2 (A & B). The LEDs of Fig. 2B are operated as a combination inverse function engine power indicator and brake light. During non-braking conditions

vehicle power 68 of Fig. 2C conducts through the normally closed side of form C contact 32 to voltage regulator E6 at location 35. The 5-vdc output from E6 conducts through the normally closed contact of relay K5 at location 67 to the positive side of said LEDs depicted in Fig. 2B. Throttle position sensor voltage is conducted through the normally closed side of form C contact 20 to input pins 5 of dot/bar drivers 42 and 43. The internal voltage dividers of dot/bar drivers 42 and 43 are connected in series. The low end of the voltage operating range of the series dot/bar drivers is adjusted by variable resistor R12 at location 60 and connected to pin 4 of bar driver 42. The high end of the voltage operating range is adjusted by potentiometer R9 at location 61 and connected to bar driver 43 at pin 6. Input voltage 77 from the throttle position sensor to pins 5 of bar drivers 42 and 43 that is above the adjusted low end voltage, and below the adjusted high end voltage, will operate the bar driver outputs and illuminate the LEDs. Operation of the vehicle brake circuit will energize relay K2 at location 31 and disconnect input pins 5 of bar drivers 42 and 43 from the throttle position sensor input voltage 77 and connect said input pins 5 to circuit common 72. Circuit common connected to the inputs of bar drivers 42 and 43 will switch off all bar driver outputs and illuminate all LEDs on Fig. 2B. Also, contact 32 Fig. 2C of relay K2 at 31 operates disconnecting vehicle power from regulator E6 at location 33 and connecting said power to regulator E5 at location 34. The 5-vdc output of E6 is replaced by the 7-vdc output of E5 and connected to the positive side of the LEDs in Fig. 2B to increase the illumination of said LEDs to that of brake lights. Operation of either the left turn signal at 65 or right turn signal at 66 will energize relay K5 at location 67 and open the normally closed contact 70. Opening contact 70 will inhibit illumination of the LEDs of Fig. 2B operating in the power indication mode. Opening contact 70 during brake light function mode will not inhibit said brake light function.

18. The LEDs of Fig. 2A function as a combination park light and directional signal lights. During non-directional signal operating conditions, 5 vdc is supplied to the anodes of the LEDs of Fig. 2A. If a left or right turn is signaled, the 5 vdc on the signaled side of the display is replaced by 7 vdc, and the signaled side operates in a stepped sequence illuminating from the center to the outer illuminating segment

during each signal pulse of voltage on said signaled side. The opposite side continues to illuminate in the park light mode. Also, if the LEDs of Fig. 2B are operating in the power display mode, they will be inhibited during turn signal operation of the LEDs of Fig. 2A.

19. Park light function of the Fig. 2A LEDs is accomplished by conducting positive vehicle battery voltage on Fig. 2D through the normally closed side of form C contact 50 as input to display left side bar driver 53 at pin 5, and through the normally closed side of form C contact 57 to the input pin 5 of right side bar driver 54. Plus 5 vdc is conducted through the normally closed side of contact 51 of relay K3 at location 49 to the left side LED anodes of Fig. 2A at G, location 36, and through the normally closed side of form C contact 56 of relay K4 to the right side LED anodes of Fig. 2A at H. With positive battery as input to pins 5 of bar drivers 53 and 54 in Fig. 2D, all bar driver outputs are switched on and all LEDs in Fig. 2A illuminate at park light intensity.
20. When the first left turn signal positive voltage pulse is applied at 63 on Fig. 2D, it conducts through diode D1 charging capacitor C1 at location 62, and energizing relay K3 at location 49. The discharge of C1 through the coil of K3 maintains K3 in an energized state between turn signal voltage pulses. Form C contact 50 operates removing positive battery from input pin 5 of bar driver 53, and replaces it with a positive left turn directional signal voltage pulse. The positive left turn signal voltage pulse on input pin 5 of bar driver 53 will cause the outputs of bar driver 53 to switch on, beginning with output one which is connected to the left center LEDs C1 A&B, and ending with output ten which is connected to left end LEDs C10 A&B. At the end of the left turn signal voltage pulse the left side display illumination will extinguish until the next left turn signal voltage pulse restarts the illuminating sequence. The second form C contact 51 of relay K3, location 49, operates and switches the anode supply voltage of the LED display left side from positive 5 vdc to positive 7 vdc increasing the illumination intensity of the left side of the display during operation of the turn signal function. Removal of left turn signal positive voltage pulses from 63 de-energizes relay K3 location 49, reconnecting battery positive to input pin 5 and allowing the LEDs anode supply voltage to change from

plus 7 vdc back to plus 5 vdc thereby returning the left side of said display to the park light function.

21. When the first right turn signal positive voltage pulse is applied at 64, it conducts through diode D2 charging capacitor C2 at location 71, and energizing relay K4 at location 55. The discharge of C2 through the coil of K4 maintains K4 in an energized state between turn signal voltage pulses. Form C contact 57 operates removing positive battery from input pin 5 of bar driver 54, and replaces it with a positive right turn directional signal voltage pulse. The positive right turn signal voltage pulse on input pin 5 of bar driver 54 will cause the outputs of bar driver 54 to switch on beginning with output one, which is connected to the right side center LEDs D1 A&B, and ending with output ten which is connected to right end LEDs D10 A&B. At the end of the right turn signal voltage pulse the right side display illumination will extinguish until the next right turn signal voltage pulse restarts the illumination sequence. The second form C contact 56 of relay K4 location 55, operates and switches the anode supply voltage of the LED display right side from positive 5 vdc to positive 7 vdc increasing the illumination intensity of the right side of the display during operation of the turn signal function. Removal of right turn signal positive voltage pulses from 64 de-energizes relay K4 location 55, reconnecting battery positive to input pin 5 and allowing the LEDs anode supply voltage to change from plus 7 vdc back to plus 5 vdc thereby returning the left side of said display to the park light function.
22. Figure 3 (A & B) depicts a third embodiment of the invented inverse function illuminating power meter 82, Fig. 3A, with a typical operational electronic circuit. This description is of an illuminating inverse power meter and operates to wit: An output dc voltage from a throttle position sensor is input to this circuit at 87. Said dc voltage conducts to input pins 5 of dot/bar drivers 85 and 89. The bar driver outputs 95 of bar driver 85 are connected to the left side LEDs at L, Fig. 3A location 93, and the bar driver outputs 96 of bar driver 89 are connected to the right side LEDs at M, Fig. 3A, location 94. Variable resistor R24 at location 92 is adjusted for the low end of the operating range and connected to the first bar driver 85 at pin 4. The high end of range is adjusted with potentiometer R27, location 90, and connected to the second

bar driver 89 at pin 6. Input voltage at or below the adjusted low end of range will illuminate all LEDs of the display of Fig. 3A. Input voltage increases above the low-end set point will extinguish the LEDs of the display, Fig. 3A, beginning with the left and right outermost LEDs 20A and 20B and work toward the center of the display. Input voltage at or above the high-end set point will extinguish the center display LEDs 1A and 1B, and all LEDs of the display. Voltage regulator E10 of Fig. 3B at 83 supplies 7 vdc to the anodes of display 82 LEDs of fig. 3A, and regulator E11 at 84 supplies 5vdc to the dot /bar drivers 85 and 89. Battery common is supplied to all components of the circuit at 88. J at 80 and K at 81 of Fig. 3A indicate the illuminating elements of left and right halves of display 82. R28 at 86 is a required load current adjusting resistor for dot/bar driver 85.